
ICI
Magazine
JULY 1960

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The I.C.I. Magazine

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FRONT COVER: *Golden Canyon in Death Valley, California, by F. Baranyovits, Jealotts Hill*
(Rolleicord camera, Ansco colour film, 1/250 sec at f5·6)

Contributors

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POINT of VIEW

AID FOR INDUSTRY

By Mark Abrams

In February of this year *The Times* published a table headed "Possible Government Aid To Industry Over £200 millions." The account that followed made no mention of the £285 millions spent by the Government on agricultural subsidies during the preceding twelve months, but dealt with probable Government loans and grants to five main industries—steel, motor cars, shipping, cotton and aircraft.

This public aid to private enterprise has three main objectives. In some instances it seeks to persuade some private firms to switch their development plans from areas where there is an acute shortage of labour (e.g. the Midlands) to areas where there are pools of unemployment (e.g. the Merseyside and Scotland). Sometimes it provides private firms with capital which they could not obtain easily from ordinary investors; and, on other occasions, it aims to encourage private firms to amalgamate so as to create larger and more efficient units of production and management.

The most recent proposal for aid comes from the Chandos Committee which has recommended that the Government should provide an £18 million loan towards the cost of building a replacement for the Cunard Steamship Company's "Queen Mary." The justification put forward for this move is that Britain's national prestige will suffer if the rapidly dwindling proportion of all transatlantic travellers who use this form and class of travel do not have a British liner at their disposal.

A generation ago Government intervention of this kind was being denounced in highly praised books with such titles as *The Road to Serfdom*. Nowadays there are no such denunciations. Public opinion and expert opinion seem to have changed completely. Earlier this year a sample of all adults throughout the country was asked: "Apart from complete public ownership, how much Government regulation of industry would you say is necessary for the good of the country as a whole?" Less than one person in every five replied that none is necessary. Most people were of the opinion that either a good deal or at least a fair amount of Government intervention is necessary; and these advocates of State intervention came from every political party.

In many ways the present mood and policy are sensible and praiseworthy. It is not always automatically true that only those ventures which yield a private profit are of public value, and it is a pity that this was not admitted and acted upon much earlier in our industrial history. But it is arguable that the present mood is insufficiently critical, and that the public interest is not really served by too ready a recourse to Government loans and grants as a means of guiding economic affairs and stimulating business wisdom.

It is impossible to establish any standards by which to measure the profit and loss to the community of every piece of Government aid to private industry, but those who advocate extensions of this policy of State generosity ought to be made aware of two facts that are undoubtedly related to it. The first is that since 1954 there has been no real decline in the relative burden of British taxation; we still hand over each year about one-third of the National Income to the tax gatherer and rates collector. This is a very heavy rate of taxation and, indeed, is one of the highest in the world. The burden would be lighter if the Government spent less on grants and loans to industry.

The second fact is that in the industrial "productivity league" Britain's performance, in spite of all this Government aid, is far from impressive. Each year the United Nations publishes a World Economic Survey. The latest volume has a table showing for each of eleven industrialised countries the average rate of growth in industrial output since 1950. For Britain the score is slightly above 2% in the average year; in five other countries—Japan, Holland, Italy, France, West Germany—it has been at least double that rate; and in all the other five countries it has been higher than in Britain. In the light of these facts some people may argue that what we need is more Government aid for industry. But that is hardly the conclusion most likely to spring to the mind of the ordinary man.

The opinions expressed in this article are not necessarily those of the Company

WONDER FOAMS

made from isocyanates may transform . . .

TRANSPORT · SHIPPING · INSULATION · CLOTHING FURNISHING · KITCHENS PACKAGING . . .

By J. M. Buist

Recently I.C.I. announced that a new plant to make isocyanates—the basic chemical for polyurethane foams—would be in production early next year. Where will these foams be used? The answer is, almost everywhere—from making your home more comfortable to transforming the techniques of shipbuilding.

THE beginning of a new decade is a favourite time for making predictions. Without adding my voice to those who claim to know whether man will or will not reach the moon by 1970, I should like to make my own modest prediction for the 1960s. It is that a boom comparable to the still-continuing plastics boom of the 1950s will be enjoyed by a material that is now almost unknown by name to the man in the street: polyurethane foam.

Neither a plastic nor a rubber, it has some of the qualities of both, as well as some important qualities of its own, and already (but anonymously) it is making quite an impact on daily life. You may come across this foam in pillows, mattresses, cushions, car seats, shoulder pads and shoe heels, as insulation in ships' holds—almost anywhere, in fact, where strength plus flexibility, or rigidity plus lightness, or lightness plus insulation, or lightness plus buoyancy, are needed. Yet only a few years ago this remarkable material was a chemical curiosity with an uncertain future.

The story of I.C.I.'s interest in polyurethane foams begins, rather strangely, with barrage balloons. During the war the Government put out a call for a new gas-proof material for making these balloons. The answer came from Dyestuffs Division in the form of a new kind of synthetic rubber, 'Vulcaprene.' In fact it was 1944 before full-scale production of 'Vulcaprene' began, and by that time the need for more barrage balloons had receded. (The research done on 'Vulcaprene,' however, later gave rise to a whole series of resins and adhesives which have been most successful: one of these adhesives, for example, was used for bonding the 6 miles of 'Terylene'/rubber conveyor belt supplied to Russia last year.)

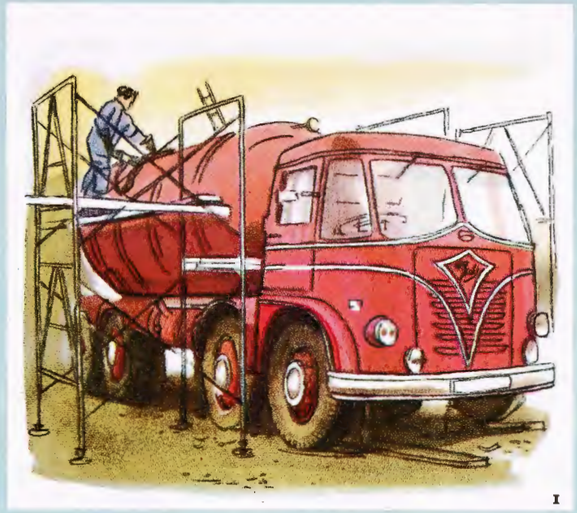
'Vulcaprene' comes into the story because chemicals called isocyanates were used in making it and in curing it to its final shape. The research team at Blackley took note of the fact that when these isocyanates were mixed with water and a polymer, the result was a foam. But at the time they made no practical use of this discovery—there were more pressing things to be done—and it was not until after the war that the remarkable foam-producing qualities of isocyanates were examined again for practical possibilities.

Isocyanates are extremely reactive chemicals—that is to say, they are ready to get together with almost any other chemical that comes along. Mixed with water, they give off carbon dioxide gas and a little heat. With the right kind of resin they react to form a rubbery substance called urethane. *So that if you mix an isocyanate with water* and *a resin, you get carbon dioxide bubbles foaming the polymer and heat cross-linking it to make a polyurethane. The polyurethane foam sets almost at once—a structure of fine cells enclosing bubbles of carbon dioxide. According to which isocyanate and resin you use, the result is a rigid, semi-rigid or flexible foam.*

This reaction is very neat and simple: you could carry it out for yourself in a tooth-mug, given the right materials and a way of measuring them accurately. But a good many practical problems had to be solved before the foams could be considered a commercial proposition. It was easy enough to measure and mix the ingredients in the laboratory, but would it be so easy to do it on an industrial scale? If I.C.I. was going to market the chemicals, it would also have to design the machinery for using them. How would the foams compare in use with foamed natural rubber or foamed plastics? They would have to show clear-cut advantages to be worth while. What was the best isocyanate for the job? There were several to choose from, and making any of them would be a major undertaking: it was important to back the right horse.

Dyestuffs Division, long associated with the natural and synthetic rubber industry, was well equipped to tackle these problems. One of the first decisions made was to concentrate on liquid isocyanates, and so make it easier to devise equipment for measuring and pumping accurate quantities of isocyanate, water and resin through a mixing head. The one chosen was tolylene diisocyanate, known as TDI for short, and by 1956 I.C.I. was in a position to put on the market the chemicals and equipment suitable for casting a continuous block of flexible foam up to 20 in. thick and 54 in. wide. At about the same time an I.C.I. rigid foam system, using another isocyanate, was put on the market.

Exceptionally light, a block of rigid foam can easily be lifted by a child smaller than itself



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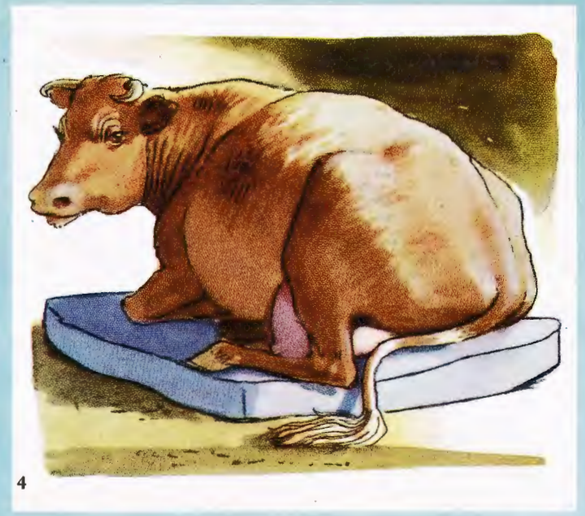

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1. *Rigid foam being poured between the outer and inner walls of a tanker, where it will form a ¾ in. thick layer of insulation.*

2. *Polyurethane foam provides first-class insulation for a refrigeration store.*

3. *Bells being rung in a belfry whose floor is covered with flexible foam, giving less reverberation.*

4. *A mattress of flexible foam enables cows to be bedded down without straw.*

5. *Steel plate covered with a layer of rigid foam in shipbuilding can subsequently be welded in situ without damaging the foam.*

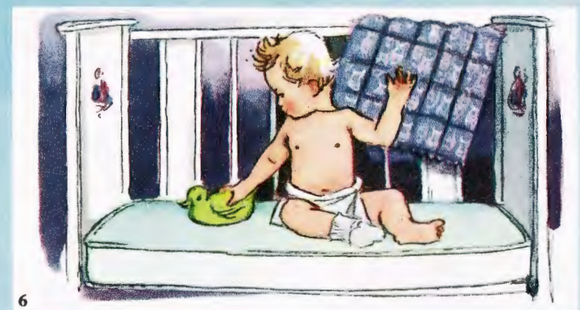
6. *Flexible foam provides an ideal mattress for baby's cot.*

7. *A flexible foam shock pad doing useful service at an unloading ramp.*

8. *A canteen trolley bumps against high-strength, lightweight doors made from a laminate of rigid foam and light alloy or wood.*

9. *Rigid and flexible foams provide first-class insulating materials for service piping conveying industrial liquids.*

10. *Flexible foam shock pads can save a driver's life.*



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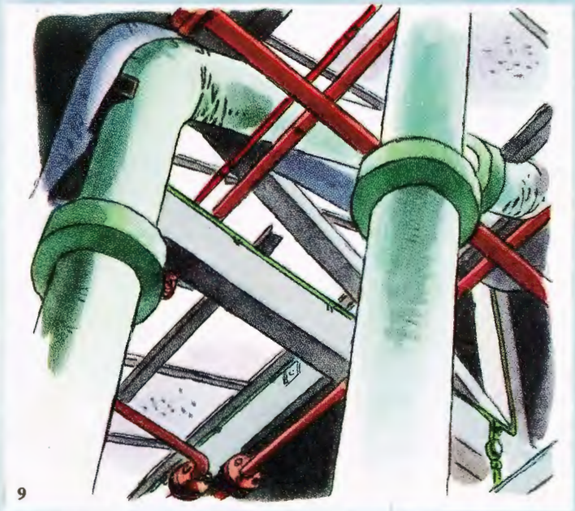

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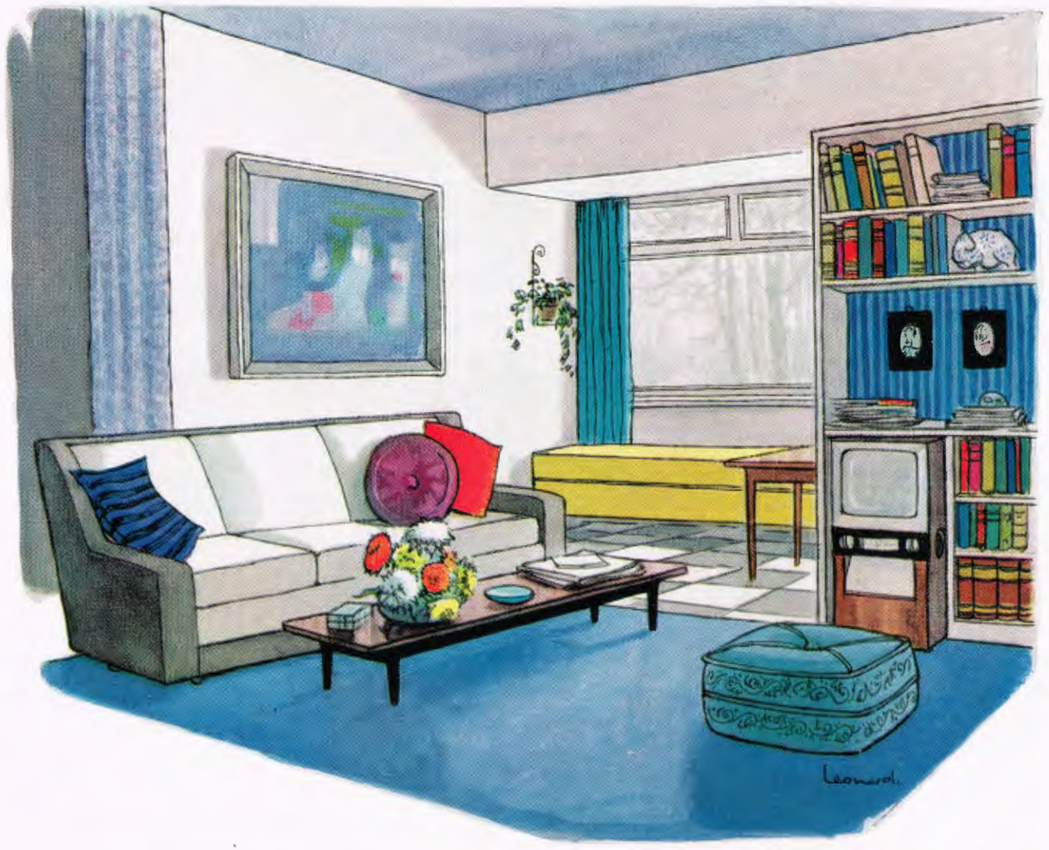


A living room of the not so distant future. Sofa, cushions, seats and pouffe are filled with soft flexible foam, the carpet has a foam underlay, the ceiling is insulated with rigid foam, the walls with a layer of flexible foam. The curtains hang full and luxurious with a layer of foam between material and lining. Draught-free windows are sealed with flexible foam.

First, the flexible foams. According to the type and amount of resin mixed with the isocyanate, these can vary from the shock-absorbing, almost soggy type, suitable for protecting delicate electrical instruments, to the highly resilient, bouncy type, suitable for mattresses (even cows' mattresses—an Oxfordshire farmer has put it to the test!) or for the dumping pads used, for example, when a huge reel of newsprint is rolled off a lorry on to the ground. Quite apart from this great versatility, they have distinct advantages over foamed rubber. They are lighter, and although the raw materials cost more than raw rubber, the price is constant (whereas the price of rubber fluctuates) and the manufacturing machinery is cheaper and simpler. Urethane foams also age better, and resist chemicals and oils better, than foamed rubber.

Most of the uses for these foams developed by I.C.I.'s customers, therefore, have been for things for which foamed rubber was used in the past—mattresses and cushions, for example. But polyurethanes are also doing a number of jobs in their own right—such as the insulation of textiles. The important advantage of polyurethanes used in clothing is that they are not affected by dry-cleaning solvents or by ordinary washing. They can be cut easily, and sewn, stuck or heat-sealed to fabrics, and they will not shrink, stretch or mat into lumps, as will so many of the conventional materials used for interlinings. (One use not foreseen by the technical service staff at Blackley was for the women's full underskirts that were in vogue recently.)

There is an obvious future for flexible foams as carpet underlays—strong, resilient, light, moth-proof and non-slip. Experiments have also been carried out with flexible foam backings on different types of linoleum.

Now for rigid foams. These—strong, light, and with the power of sticking to metals such as aluminium—first attracted the attention of aircraft designers. They found they could add strength and rigidity to a wing, for instance, at very little expense in weight by filling the wing-space with rigid foam. The technique was to pump the measured chemicals into the space and allow them to foam and set in place. The isocyanate being sold for I.C.I.'s flexible foam system was considered unsuitable for use in confined spaces, being slightly toxic, and another system was devised, using diphenyl methane diisocyanate. Aircraft companies and industrial refrigeration experts co-operated with I.C.I. in developing this rigid foam system, and by 1956 it was put on the market.

From the first it had obvious attractions as an insulating material for ships. Rigid urethane foam is not only very strong for its weight, but "locks up" so much still air in its fine cells that it insulates even better than fibreglass. *An insulation company proved this by insulating a refrigerated compartment in one ship with fibreglass, and an identical compartment in another ship with rigid urethane foam 2 in. thinner. The urethane foam proved 23% more efficient.* Refrigerated holds in a great many ships have now been insulated with rigid foam, and insulation contractors take the view that the shipping industry has never before accepted a new material so readily.

Because it is such a good insulant, the foam can be used less thickly than other materials, so saving weight and valuable cargo space. The liquid mix expands as it foams in the cavity wall of the hold, sticking to the metal as it sets. And also—an unlooked-for bonus—it contributes to the fight against corrosion by using up in the foaming reaction any moisture that happens to be on the surface of the metal. If welders subsequently have to work on the outer plates of the ship there is no need for either the foam or the contents of the hold to be removed before the work is done.

To shipowners, weight saved in the construction of ships means money in the bank: every ton less deadweight means a ton more cargo. Quite apart from their use as pure insulation, these rigid foams have made possible some dramatic weight savings. One ship was fitted with a food store door made of urethane foam sandwiched between thin layers of wood (weight 109 lb.) to replace a timber door (weight 330 lb.). You can imagine the weight saved in another ship which had 250 of such doors fitted. Laminated decking incorporating rigid foam is also being made in this country, and a number of ships have had their rudders filled with foam to reduce the ingress of water and so check corrosion. On land, lightweight doors made of rigid foam sandwiched between aluminium are being used on the railways and in offices, and the same kind of laminate can be used for the curtain walling with which modern buildings are clad. One use developed in the early days and since widely adopted is the filling of women's shoe-heels with foam. As an insulant, urethane foam is being used on chemical plant (including much of I.C.I.'s,) on road tankers and in cold stores. Several motor-car companies have carried out promising trials with rigid foams.

Exceptionally strong, a small piece of foam will support a man

There are many developments yet to come. The wide range of plastics now available makes a large number of different laminates possible, and Dyestuffs Division and Plastics Division are working on these together. A considerable amount of work, too, remains to be done on the machinery for applying the foam. Recently Dyestuffs Division has developed a spray process quicker than *in situ* foaming for the insulation of ships' holds; a layer of very fine-textured foam up to $\frac{3}{4}$ in. thick can be applied in this way at the rate of 24 square feet per minute.

Although I.G. Farben in Germany were the first to make practical use of urethane foams, to be followed soon after by Du Pont in America, I.C.I. very quickly made up for lost time. The I.C.I. range of products—backed by the technical service that has made Dyestuffs Division world-famous—is highly competitive.

NEWS IN PICTURES

Home and Overseas

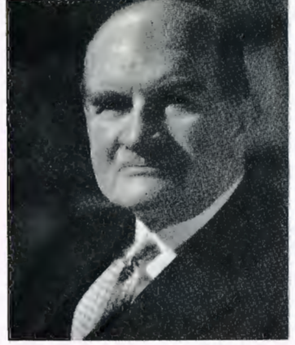
A.G.M. Our photograph, taken at The Wigmore Hall on 12th May, is believed to be the first ever to be taken at an I.C.I. Annual General Meeting. The Chairman, Mr. S. P. Chambers (centre), with members of the Board of Directors, addresses shareholders attending the meeting

'Savlon' windbreaks form a novel part of the beach scene in New South Wales. They were supplied by I.C.I.A.N.Z. to Surf Life-saving Clubs at the suggestion of a local Australian Pharmacist Association

Top level talks. The managers of three of the largest paint companies in the three major Commonwealth countries recently met in Montreal to discuss common problems. They are (left to right) Mr. N. G. Wilson, general manager BALM Pty., Australia; Mr. R. C. Williamson, general manager, Paints Division, C-I-L.; and Mr. E. J. Callard, chairman, I.C.I. Paints Division

Boots galore are seen being stitched with 100% 'Terylene' sewing thread by a Singer machine which is fixing outside counters to "Winnit" brand football boots

Plastics in Russia. Mr. Khruschev, accompanied by half the Presidium Central Committee, visits a unique exhibition of I.C.I. plastics opened in Moscow on 3rd June by Sir Patrick Reilly, the British Ambassador to Russia. This is the first time a foreign plastics exhibition has been held in the Soviet Union. With Mr. Khruschev are (left and right) Mr. B. Pidgeon, Export Manager, R. H. Windsor Ltd., and Mr. J. W. B. Peel, I.C.I. European Department.



Field Marshal Sir William Slim, lately Governor-General of Australia, was made a viscount in the Birthday Honours and installed as a Knight of the Garter on 13th June. Sir William Slim was appointed a director of I.C.I. in March

Mr. E. T. Grint, the Company's Chief Labour Officer since 1952, received the honour of the C.B.E. last month. Mr. Grint was formerly a director of Nobel Division and is now a member of Billlingham Division Board

Mr. L. Patrick, Head of Government Contracts Department since 1947, received the O.B.E. In addition to direct Government work, he is also responsible for the Atomic Energy Authority's research and development contracts with I.C.I.

Mr. T. V. Keelan, Assistant Division Education Officer at Plastics Division's Darwen Works, was designated M.B.E. He is responsible for training supervisors and managers at Astley Bank training centre and is an Alderman of Darwen Town Council

100 years old, this organ was recently restored by Mr. and Mrs. John Snell of the Steatite and Porcelain Products factory. It is installed in the parish church of Witley, near Stourport. (See story on page 246)

Pony express. A parade of ponies clad in safety slogan sandwich boards toured Wilton's Nylon Works as part of a recent safety campaign. This novel idea, thought up by Nylon Works' Safety Foreman, Mr. J. Greenhalgh, told the safety story effectively over about four miles round the Wilton site

The B.E.M. was awarded to Mr. C. L. Oakes of Plastics Division's Wilton Polythene Plant. He joined I.C.I. when he was 14, in 1925, and since 1940 he has been concerned with the construction of polythene plants at Wilton, in the U.S.A., Australia and India

Mayor of Buxton. Mr. T. H. Garton, a Works Councillor at Alkali Division Lime Works, addresses the council meeting at Buxton Town Hall after being made mayor on 24th May

Pinturas Servicio, the paint company in Mexico in which I.C.I. has acquired a majority holding, opened a new factory at La Presa in April. Here (left to right) Mr. R. C. Todhunter, Overseas Director, Mr. J. L. Grover, General Manager, Pinturas, and Don Enrique del Castillo (who formally opened the factory in the name of the Governor) stroll through the factory grounds after the opening ceremony

Local affairs is most likely to be the subject under discussion for Messrs. J. Lewis, J. Mulgrew, G. Goldie, Dr. L. Currie and P. McLellan, all of Nobel Division's Ardeer Factory. All five were returned as town councillors when Scotland went to the polls to elect her municipal representatives

The Queen's Badge, the highest proficiency award obtainable in the Boys' Brigade, was presented recently to two apprentices at Nobel Division's Ardeer Factory. Here Sergeant Edward Milligan (right) admires Corporal Stewart Kirk's badge

Putting the shot. Mr. Bill Robbins of Billingham Division put the weight a distance of 40 ft. 4 in. to win the event for the Synthonia Club in a triangular athletics match with Sheffield University and Bede College recently

One Man and his Job

THE WELDER

Interviewed by Denzil Batchelor

How does 50-year-old Bernard Taylor come to be heading a team of I.C.I. welders working on a nuclear site in Mol, Northern Belgium? Well, the story begins when the Belgian authorities set about finding who could best fill an order worth more than £100,000 for welded aluminium piping for their new water-cooled nuclear reactor. The chosen firm was Marston Excelsior, Wolverhampton, part of Metals Division, and I.C.I. (Belgium) S.A. have acted as agents in connection with this important contract.

Why did they get the job in preference to Belgian and other firms tendering for it? The short answer is "know-how." Marston Excelsior have had years of experience working in light alloys and did of course provide most of the aluminium welded fabrications for the U.K. atomic energy diffusion plant at Capenhurst, Cheshire.

Note the word "welded"—that is where Bernard Taylor comes in. He was originally an electrical engineer at Marston's, and with the advent of the argon-arc welding technique his experience helped him to acquire expert knowledge of the new process. Until then welding of aluminium had been carried out by the oxy-acetylene torch or metal arc using flux, but the new electric argon-shielded arc revolutionised light alloy welding methods.

Marston's were one of the first companies in this country to apply this new process to the fabrication of aluminium, and Bernard Taylor obtained valuable experience in these early days. Thus it came about that he is now supervising in Belgium the important site welding job.

It will have taken some nine months before he and his men finish welding that vast circulating system, perhaps nearly 600 ft. long, with its many branch lines of aluminium alloy pipes from 1½ in. to 30 in. in diameter (a total amount of 3000 ft. of pipe) connecting the reactor shell to the heat exchangers and the exchangers to the cooling pond.

Don't forget that the job, although welded by Marston, has to be erected with Belgian subcontractors, only one of whom speaks English fluently. Much of the technical conversation has been—perfectly satisfactorily—in sign language! You would not expect such a job, assigned to a foreign firm over the heads of Belgian competitors, to go through without the slightest hitch in the shape of site troubles. It's a tribute to the diplomatic gifts of I.C.I. (Belgium) and all concerned that these have all been painlessly smoothed over.

But no amount of diplomacy can simplify the job. That—because this is work on a nuclear site—is as exacting as a welding job can be. Bernard's team will concentrate on a circumferential joint, and the work will seem perfect until the severest X-ray test of every inch reveals perhaps one microscopic porous area—enough to put the team back on the job straight away.

It is tough work as well as precise, especially in hot weather. The welder wears a mask (as sported by the bushranger Ned Kelly) weighing up to 2 lb. He is dressed in non-inflammable dark material—dark because any near-white garment would reflect the rays given out by the welding arc.

The pipes themselves are of light alloy, more than 90% aluminium. On this particular job the utmost attention must be paid to cleanliness: before welding begins there must be no grease or foreign bodies on the pipe. Once the weld is made, it is not only X-rayed but also subjected to heavy hydraulic pressure to ensure that there are no leaks. In the past ten years Bernard Taylor has trained some 100 men to work as welders in I.C.I. The qualities he looks for are a gift for concentration, conscientiousness, a readiness to attend to detail, a good eye and a steady hand.

From Mol, Taylor gets one weekend in England each month. For the rest of the time he lives in a café boarding house, doing the job and thinking about it. He hardly ever goes to the cinema. You see, he cannot hear the English sound track, unintelligible to the Belgians and therefore played pianissimo—and he cannot understand the captions in French and Flemish! He was a motor cycle trial rider as a youngster, but as a married man with two daughters he has given up this hobby.

He has been a Wolves fan since 1921, and thinks Stanley Cullis was the greatest centre half he ever saw, Peter Broadbent the best inside forward, and Bert Williams the best goalkeeper. But with him the order is Welding first—Wolves second.

Bernard Taylor

THE MECCA OF MARKSMEN

By Dorothy Thomas

I.C.I. ammunition was again used by the champion marksman winning the Earl Roberts Memorial Trophy. Here Dorothy Thomas of Metals Division gives her impressions of Bisley's happy and informal atmosphere.

A SIREN wailed, the prone khaki-clad figures raised their weapons, shots splintered the summer air.

Flashback to the 1940s? Film set? Neither. This was Bisley, 1960—more accurately, the National Small-bore Rifle Association Meeting. The qualification is important because there are, in fact, two "Bisleys," one for people using Service rifles and the other for N.S.R.A. members, who use small-bore target rifles. Neither, incidentally, is held at the village of Bisley itself, but at the camp of that name at Brookwood, in Surrey.

Most of us, I suspect, have very little idea of what goes on there. I.C.I. people know that a great deal of Kynoch ammunition is used for target shooting: those domiciled at Witton see half a dozen colleagues disappear one June day with rifles and ammunition and return a week later with a unique bag of elaborate silverware. Casual references to "possibles" and squadded aggregates drift about the offices from time to time, but, like all jargon, serve only to mystify or irritate the uninitiated.

This year I had a chance to see for myself what it was all about, and no traveller ever had a less accurate mental picture of journey's end. Bisley to me had something of the same association as Henley—a place where the most skilled devotees of a rather expensive sport gather to demonstrate their prowess and enjoy even more expensive social delights. The shooting range itself, I thought, would be ultra-modern and super-efficient, the ritual grave and dedicated, the excitement at peak moments intense.

Road signs led us through narrow leafy lanes, flanked by charming cottages and rambling club-houses, on to a large common. All my illusions were dispelled before the car was parked.

In place of the small, elegantly appointed enclosure I had visualised there was an enormous sprawling area of natural grassland, half of it hidden by cars, caravans and tents of every shape, size and vintage. My exclusive group of expert shots and fashionable "fans" expanded instantaneously into a couple of thousand casually dressed campers—toddlers, teenagers, parents, grandparents, and not a few dogs. Britain's most famous shooting range revealed itself as a narrow plateau of open land, clothed in grass which knows not 'Verdone'; the bank at one side was topped by a simple structure of poles and canvas, the shelter from which marksmen shot at targets placed 25, 50 or 100 yards away. Positively the only things that were as I expected were the fluttering scarlet flags warning that firing was in progress.

Bisley, I found, is like the best sort of party. The prevailing atmosphere is so relaxed that the back-

The final target shot by Arthur Skinner when he won the Earl Roberts Memorial Trophy for the second time in succession, using I.C.I. 'Tenex' ammunition. To achieve a "possible" on a final card is a remarkable feat.

ground organisation never shows through. But its efficiency is remarkably impressive. The object of the meeting is to test, in individual and team

A general view of the ranges—"a sprawling area of natural grassland"

THE COST OF DISCOVERY

By F. L. Rose, Pharmaceuticals Division

Before a new drug reaches the stage of clinical trial in man, the bill may be as much as £200,000. Moreover, clinical trial is only the last of a long series of tests, begun perhaps 3 or 4 years previously

This article is reprinted from the "Financial Times" by kind permission of the Editor.

THE 1958 British Pharmacopoeia describes, *inter alia*, 250 synthetic drugs. The edition in use when the National Health Service began contained 36. On the basis of present-day values, it can be estimated that the current list is the outcome of world-wide research costing £50m., and this figure relates only to the likely sum expended up to the point of the initial laboratory observation of potentially useful biological activity in a compound prepared in minute quantity. It does not include the cost of process development to pilot and then full-scale plant manufacture, of formulation research, and of all the expensive preliminaries to a clinical trial in human or veterinary disease. By contrast, a popular television set introduced a few years ago by a well-known manufacturer in the electronics industry was advertised as having "cost" £100,000!

Why is the discovery of a new drug so much more expensive than a comparable event in other branches of applied science, even say in the near-related fields of dyestuffs or rubber chemistry? The answer is complex, and is best provided by a description of the processes and principles involved.

Two Sections

Basically, a chemotherapeutic research unit comprises two closely linked parts, the one responsible for the synthesis of the potential new drug and the other for its biological assay. These two halves form the axis around which the whole organisation revolves. But for fruitful and expeditious discovery, even in the laboratory, the two groups must be assisted by scientists drawn from many other scientific disciplines such as physics, veterinary and human medicine, biochemistry, pharmacy, pathology, and so on.

Indeed, it is probably true to say that the invention of a new chemotherapeutic agent is unique in the number and variety of disciplines called into play. Ideally, the people concerned should function on the same site. Many of them will require expensive equipment for their studies, and because of the nature of their work a high standard of laboratory housekeeping is called for, so that capital and maintenance charges are maximal. In our Alderley Park Laboratories each senior graduate has associated with his activities 2500 sq. ft. of floor space and the services of five supporting personnel.

Wide Field of Study

The chemistry of drugs knows no limitations, and in this it differs from that of dyestuffs, which is confined to comparatively few types (azo, anthraquinone, indigoid, etc.). The medicinal chemist has to range over the whole vast field of organic chemistry, which is after all the chemistry of the living process, and he has to keep in closest touch with new developments in the science. His approach is therefore more academic, and consequently the outcome of his work is often itself an important contribution to new and fundamental knowledge.

This was seen in the collaborative wartime research of I.C.I. with the universities on antimalarials. Fifty papers were published in the *Journal of the Chemical Society*, contributed by 40 authors drawn equally from the industrial and academic laboratories. Even today, the laboratories of the pharmaceutical houses provide a high percentage of the papers on organic chemistry that appear in the journal.

The search for a compound having a defined biological effect may ultimately lead to a new substance of great molecular complexity, or, as sometimes happens, it may end in a simple compound already described in the purely scientific literature. In the latter event, the possibility of really effective patent cover is remote, which means that the discoverer's own organisation, loaded with heavy research overheads, will be at a disadvantage in marketing the product at a competitive price.

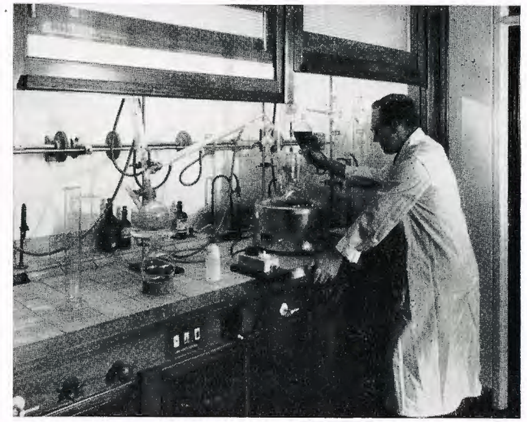
Stringent Tests

Another distinctive feature of the chemical research is the large number of compounds (on average about a thousand) that require to be made before finality is achieved. The successful drug must be freely absorbed by the human body, yet non-toxic and resistant to excretory and metabolic process. To exert its curative effect it must find its way in adequate concentration and remain in contact long enough with the target cell, be it a tubercle bacillus or a specific organ in the body. On any one of a score of such properties it may fail. By comparison, the dyestuffs chemist has only to consider chemical structure in relation to colour, fastness properties and affinity for a fibre. He is not concerned even with purity, let alone such matters as sterility.

The biologist also has his problems, the greatest of which is to translate a disease as it occurs in the human body to a condition as closely related to it as possible in the smallest laboratory animal. Further, it is necessary for the experimental disease to be capable of statistical assessment as to its severity and to be sensitive to the trace influence of the first scarcely active drugs sent in by the chemist. In all of this the biologist, like the chemist, leans heavily on the scientific literature, and in turn makes his own contribution to the published biological knowledge of disease. Because of the animal and laboratory facilities required for the task, the work of the biologist constitutes the major cost of chemotherapeutic research.

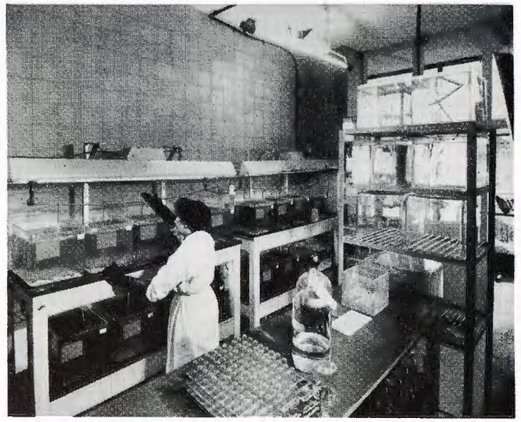
Search for Side-effects

Even with the discovery in the laboratory of potentially valuable curative properties in a new compound, its ultimate emergence as an acceptable drug is far from certain. It must now be subjected to a lengthy and detailed study as to its less obvious toxic side-effects. These are looked for by administering the drug in supra-therapeutic doses to large groups of more than one species of animal, sometimes for periods up to years, and then having the tissues from various organs examined critically by a pathologist for damage. Only if it is certain that the drug can be given to man with all reasonable assurance that no harm will be done, even if no benefit will derive, is the final hurdle of clinical trial approached. This stage may be as long as three or four years after the chemist made the first small sample, by which time small wonder that the bill has reached the £200,000 mark. Yet the resultant value to mankind may be incalculable.



Preparing one of the 4000 substances examined for biological activity every year

Millions of items of glassware have to be cleaned and sterilised every year. This is done centrally on the production line principle



Even snails have to be bred for the study of disease—in this case schistosomiasis

I.C.I. PLASTICS GO TO MOSCOW —AND TICKLE MR. K

By Margaret Farrell

Plastics Division's exhibition in Moscow last month was a huge success. Vast crowds attended and Mr. K came in person, saying "bring as much of this as you like, it is the things that come out of the sky I don't like."

RUSSIANS—we had seen them at Welwyn, broad, blue-eyed men in heavy clothes, purposeful and rarely smiling. The exhibition must appeal to the Russians.

We puzzled about the most suitable treatment at first, but soon it was clear that charts, diagrams, properties and machinery were in, fantasy and cacti out.

So we produced an exhibition for the Russian technicians with over ten thousand words of technical data supporting displays illustrating the chemical structure, raw materials, properties and processing of our most important plastics. At the end of the technical stories were the finished products. 'Alkathene' insulated cables, containers for chemicals, baby baths, bowls, buckets, squeeze bottles and a host of toys. A refrigerator lining in 'Flovic,' shoes with 'Butakon'-based soles. 'Melinex' for loudspeakers, typewriter ribbons, recording tapes and silver threaded laces. The Cresta rear lights and flashers in 'Diakon.' 'Diakon' telephones and street lighting lanterns. P.v.c. piping, 'Corvic' for gramophone records, 'Perspex' for baths and wash-basins—nearly two thousand exhibits to show the versatility of our materials.

London-made Exhibition

We built the exhibition in London and loaded it on to the s.s. *Angarak*, a Russian vessel, bound for Leningrad. It completed the journey to Moscow in a fleet of lorries.

Our liaison officer, appointed by the All Union Chamber of Trade in Moscow, was Mr. Antonoff—a darlin' man! He spoke excellent English and helped us over our difficulties with great patience. He quickly learned the exhibition slogan "keep your fingers crossed." During the ten days before the exhibition opened we became friendly and discovered that his solemn manner hid an impish sense of humour.

Victoria—called Vicky, Victoria—called Victoria, and Antonina—called Tonya, from the Foreign Exhibitions Department of the All Union Chamber of Trade, worked with us as interpreters. This was their official title, but they were so much more. They fixed our telephone calls, booked tables for lunch, kept us supplied with mineral water—Moscow is a very thirst-making place—soothed us when we were fractious, guided us gently through the maze of official regulations, cheered us when the going was hard.

Interpreting at exhibitions is a profession in the U.S.S.R. and only after several years' training and a good knowledge of at least two languages other than Russian are the girls considered good enough to tackle the strange ways of foreigners.

Vicky was small, dark and slender and full of intelligence and energy. Victoria very quiet and graceful, moving with gentle efficiency through a dozen different jobs at once. Tonya, a lovely, laughing honey blonde, took our problems in her stride, and solved them with heart-warming gaiety.

Like all the Russians I met, the girls did not appear to be very inquisitive about life in the West. Vicky and Tonya will be coming to London in 1961 for the Russian exhibition. At the top of their list of "things to do" are the British Museum and Madame Tussaud's.

Vicky was the one who steered us through the bureaucratic jungle of the Customs House and extracted the cases of gin and whisky we had brought for the reception from its reluctant fingers.

Darting about like an angry robin she would say, "So. This letter is no good. We shall write another letter." After several "no good" letters and many telephone conversations she announced: "Now I shall go to see the Minister. He shall sign this letter." At the end of the day she returned waving the letter triumphantly. "See. The Minister has written AGREED across this letter. Now you will get your whisky." And we did—with the speed of light.

Helping Hands

At the back of the Polytechnical Museum is a courtyard surrounded on three sides by flats. This was the site for the machinery demonstration organised by R. H. Windsor Ltd. To house the extruder and injection moulding machine we built a frame of Dexion slotted angle iron and covered it with non-flammable p.v.c. sheet. The building of our Dexion marquee was a source of endless interest for the children who lived in the flats. It was like having a giant size Meccano set in your backyard. Watching the Dexion gang fitting in nuts and bolts they quickly learned which should go where and joined in as extra fitters.

On the day before opening, things were moving in a rather leisurely way. The exhibition was ready, but the clearing up needed to be done and all the dusting and polishing. But there was no hurry—zero hour was still a long way off. At three o'clock we received a message from the Kremlin. Mr. Khruschev would visit the exhibition at five. I have never seen a group of people move so fast. In a couple of hours paint pots, lengths of wood, bits of 'Perspex,' coils of cable wire and empty boxes had been swept out of the way. Exhibits shone with polish and elbow grease, polythene flowers bloomed in the vases and a small army of friendly blue clad ladies had washed and polished the floor.

Waiting for Mr. K

The Ambassador and his retinue arrived—and we waited. In the exhibition room at first, then in the courtyard from which our visitors would reach the exhibition. A large crowd gathered outside the Museum where the Union Jack and the Hammer and Sickle waved lazily together in the late spring sunshine. Policemen arrived —and still we waited.

Then there was a rumour that after all Mr. K would not be coming—it would be his second in command. We felt a bit guilty about Abe Goldberg, the Associated Press man whom we had invited. All the other foreign reporters had gone to the Pasternak funeral, but Abe had settled for the Khruschev story.

"He will come," Mr. Antonoff assured us. "If Nikita Sergeyevich has said he will come, then he will come. It is something of great importance that delays him."

Shortly after six o'clock there was an outburst of clapping in the street. Mr. Khruschev and his Presidium had arrived. He looked just like his photographs—small, square, with a strong determined face and an engaging grin. His feet, in openwork sandals, are tiny and he puts them down carefully.

As he came in, with the Ambassador, Dr. Gourlay and Mr. Swallow, he was immediately surrounded by reporters, and lit by camera flashes. The rest of us stood in line behind some large gentlemen. They were very polite.

Mr. Khruschev spent about forty minutes going round the exhibition and asked some very searching questions. He greeted the 'Perspex' bath like an old friend. The machinery tent took his fancy and the machines behaved beautifully. Rigid p.v.c. pipe was extruded and the 'Alkathene' washing-up bowl slid from the mould with great elegance.

Before he left he told Mr. Swallow: "Bring us as much of this kind of thing as you like. I like it. It is the things which come to us out of the sky I don't like."

The next day the exhibition was officially opened by the British Ambassador, Sir Patrick Reilly. Three hundred guests packed themselves into the cinema which holds two hundred. Moscow's television team was there, so was our own cameraman and dozens of reporters. The crowds outside were so vast they had to be admitted in batches.

And of course it was the model kitchen and bathroom, the 'Alkathene' speedboat and the Austin Seven which aroused the enthusiasm of the Muscovites. The children swarmed round the 'Alkathene' toys, the women stroked the 'Alkathene' houseware with delighted fingers. "Glorious," said one old lady. "What you have is glorious."

Stampede for Books

Seven and a half tons of literature were sent to the exhibition. Two days after we opened we were rationing it to make sure we would have enough left for Leningrad. Although we had provided vast quantities of literature in Russian it was our brightly coloured books in English which were most coveted. Indeed it became something of a problem to get literature into the hands of the technicians. As soon as the drawer was opened a forest of hands dived in and emptied it.

It was obvious from the word "go" that the exhibition was a roaring success. On Saturday the crowd watching the moulding of 'Alkathene' bowls was so great the crash barrier collapsed beneath the weight of Soviet arms. We would have liked to give the bowls away, but this was forbidden, the All Union Chamber of Trade wisely realising that the museum would burst its walls once the news got out. But I am glad that a few of the toy racing cars and boats found their way into the right hands.

So much for the public. We had special hours for the technicians—although they came with the public too—and triangular disputations of technicians, technical service men and interpreters replaced the eager families.

Student Interpreters

Some of our interpreters were chemists from Moscow University, a cathedral-like skyscraper which was completed in only four years. Twenty-five thousand students from many nations study there. Six thousand of them are residents. Their rooms are small, but brightly and comfortably furnished. They come in blocks of two with adjoining bathroom complete with shower. There is a kitchen on the dormitory floor with half a dozen stoves for students who prefer to do their own cooking. There is a swimming pool, which the local schoolchildren may use, a gymnasium, small leisure rooms, large lecture rooms, a theatre with revolving stage, an assembly hall lit by twenty chandeliers each weighing half a ton, and a wonderful view of Moscow from the terrace at the top of the building. Oxford and Cambridge please copy.

Round the ceilings of the main halls are busts of world famous scientists. "Where is Michael Faraday?" I asked. We couldn't find him, but I was assured he is there.

FAMILY PORTRAITS

3—The Peppers of Nobel Division

THERE *might* have been a Pepper employed at Marsh Works, Faversham, when blackpowder manufacture began there over three centuries ago: Mr. Fred Pepper, B.E.M., a man of Kent who worked at Faversham for 31 years before moving to Ardeer, is not, in the absence of records, prepared to make so sweeping a claim. With the caution that comes naturally to one who has spent a lifetime in almost daily contact with the explosive, he limits his family connection to the bounds of memory.

That can go back, in direct line, three generations. He has clear, if boyish, recollections of his great-grandfather, James Pepper, tall and bearded. And when James left the employ of John Hall & Son at the age of 75 he could look back on a total of 60 years spent on blackpowder manufacture at Faversham.

Today such a record of service would be impossible to equal, but Fred, who entered the Faversham mills in the Curtis's and Harvey days, was just short of his half-century when he retired in 1953. He might have topped it, but as a foreman he was obliged to stop work at 62.

Now in his 70th year, he has not lost the clarity of mind and expression that made him workers' representative on the Faversham Works Council until the factory closed down in 1935. And the firm handshake and purposeful manner suggest a man who would be good to have around in an emergency.

As indeed, he has proved. He won his B.E.M. for his part in rescue work after an explosion at Faversham in 1916—an explosion in which three women were killed and 20 injured. But for the prompt action of Fred Pepper and three of his workmates, that casualty list might have been longer. And though Fred dismisses his part in the rescue as "no more than anyone else in my place would have done," he is proud of the silver medal with the deep crimson ribbon.

He grew up in a family of eight children. Father William, who spent 50 years in the service of John Hall & Son and of Curtis's and Harvey, saw four of his family follow in his footsteps—Fred, his sisters Ethel and Nellie, and brother Sydney. But of the children, only Fred remained at Faversham to make blackpowder his life's work.

In the previous generation there was George, father of William, whose 40 years' service is somewhat overshadowed by the 60 years of his own father, James, who might be described as founder of the Pepper tradition. Not that Fred accepts that his great-grandfather really was the first member of the family to enter the industry. If records had been kept, he feels certain it would be possible to trace the line even further back.

But if it is impossible to look deeper into the past, Fred can look well into the future. The career of his son Ronald, now a foreman in Blackpowder Department at Ardeer, follows very closely the pattern set by Fred himself. And with a quarter-century of service behind him Ronald should be able to contribute substantially to the family record.

Three years ago Ronald's son (another Frederick) started work in Ardeer Box Factory to become the sixth generation of Peppers to enter the explosive industry, so the family tradition would seem to be secure for a long time to come. For over the years the Peppers have established another tradition—the tradition of long life. Great-grandfather Pepper lived until he was 93.

Faversham Works Council about 30 years ago. Fred Pepper is standing on the left. Sitting (right) is A. P. Cattle, then works manager at Faversham.

William Pepper, who served for 50 years with John Hall & Son and Curtis's and Harvey.

A recent reunion of retired employees at Ardeer Recreation Club. Mr. Fred Pepper (left) and Mr. A. P. Cattle (centre).

Three generations of Peppers and all of them I.C.I. men. Left to right: Fred, Fred junior and Ronald.

People and events . . .

Contributing to Safety on the Farm

A NEW I.C.I. product which makes a major contribution to farm safety is now available to British farmers. It is 'Reglone,' a non-arsenical chemical which destroys potato haulm without danger to human beings or animals.

News of the imminence of 'Reglone' came to the knowledge of Mr. John Hare, Minister of Agriculture, and drew from him a letter addressed to I.C.I.'s Chairman. After referring to the agricultural chemical industry's voluntary agreement to withdraw arsenical haulm destroyers at the end of the 1960 potato harvest, the Minister wrote: "Safe and efficient chemicals for this purpose are greatly needed by agriculture, and I wish you and the industry every success in the work that is being done to find them."

'Reglone' is the result of many years' work at Fernhurst and Jealott's Hill research stations. Its haulm-destroying properties were discovered at Jealott's Hill early in 1955, and since then it has been tested extensively in field trials. As well as being safe, the trials have shown that it is, in fact, considerably more efficient than the arsenical compound it replaces. Destroying the haulm (the leaves and stem) is common commercial practice, since live haulm is liable to block a mechanical harvester.

Potato haulm destruction does not look like being the end of the story as far as 'Reglone' is concerned. Other uses, especially overseas, are being investigated.

Millions for Nylon

SEVERAL million pounds are to be spent by Dyestuffs Division to expand nylon polymer manufacture. A further plant is to be added to the Nylon Works at Wilton, and there are to be modifications to the works at Billingham.

* * *

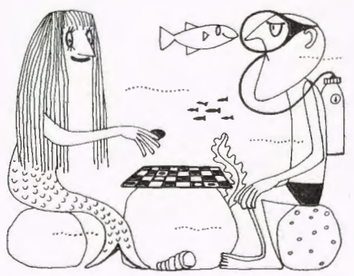
Giving news of these developments in a speech to members of the payroll and staff, **Mr. W. E. Humphreys,** Billingham Nylon Works manager, added that this expansion would ensure full employment for "a good few years to come."

He said demands by customers were so high that every ton of nylon which could be made in 1960 would be needed, and these demands should continue to rise.

Frogmen at Wilton

MEMBERS of Wilton Works swimming section took the plunge before the TV cameras recently when they gave a demonstration of the training they had received on the first of three sub-aqua courses arranged by the section.

The course, which began in February, comprises about 30 enthusiasts, who are being taught the correct way to handle and use the equipment and given serious training in sub-aqua techniques. So popular has it proved that a second course is under way, and a third planned for the autumn is already well booked up.



Crantock in Cornwall has been chosen by the section for a fortnight's swimming holiday later this month. About 20 members are taking part. Two will be taking along home-built underwater camera units, and, says **Mr. Maughan,** the section's secretary, it is the intention, among other things, to photograph a basking shark.

Mr. Maughan was also televised recently in a 3000-gallon inflatable tank at the Works Recreation Club's "Holiday Pastime" exhibition, in which he and his colleagues played a game of draughts at the bottom and also used the tank for contributions to the World Refugee Year campaign.

Stargazing Scot

As a result of a report submitted to the British Astronomical Society, **Mr. John Glasby** of Nobel Division is now the proud possessor of one of the biggest amateur-owned telescopes in Scotland. It arrived at his home in Stevenston last month, and for weeks beforehand he had been busy preparing for its arrival. The telescope has a market price of around £1500.

During the past two years Mr. Glasby, along with other amateur astronomers up and down Britain, has been studying variable stars—that is to say, stars which fluctuate in the amount of light they give out. His report won him the commendation of the British Astronomical Society, who remarked particularly on the large number of observations he had made, and they offered him the magnificent telescope which now occupies the back garden of his home in Stevenston. While Edinburgh and Glasgow observatories have larger telescopes, Mr. Glasby's is certainly one of the biggest to be operated by an amateur in Scotland. From the reports of observers like Mr. Glasby, the British Astronomical Society compiles the statistics it sends regularly to observatories at home and abroad.

Cheaper Fertilizers

BILLINGHAM DIVISION has reduced the prices of all its fertilizers. A statement announcing this was issued to the national press on 31st May and the new lower prices—in some cases as much as £1 a ton—came into force last week. The reductions, it is estimated, will represent a saving to British agriculture of not far short of £1 million in 1960–61.

The price-cuts are based "partly on increased sales in the 1959–60 season and the Company's confidence in the expanding use of fertilizers in the coming year, and partly on improved methods of production and the advantages accruing from operating I.C.I.'s new fertilizer plants at higher rates of output." These reductions are being made despite the fact that none of the raw materials involved in the manufacture of I.C.I.'s fertilizers is expected to be cheaper in 1960–61.

I.C.I. Helps Refugees

HOW I.C.I. helped refugee scientists from Nazi Germany in the 1930's is told in a recent issue of the *New Scientist*.

Professor Lindemann, later to become Lord Charwell and scientific advisor to Sir Winston Churchill during the war, appealed to Sir Harry McGowan, Chairman of I.C.I., for urgent help for the scientists. That help was given.

"As the year wore on," writes Dr. Kurt Mendelssohn, F.R.S., "the stream of refugees became a flood and the young low-temperature school at Oxford grew rapidly. In the summer, my cousin F. E. (later Sir Francis) Simon decided to give up his professorship in Germany and he, too, came to Oxford, together with Nicholas Kurti. The brothers Fritz and Heinz London joined the Clarendon Laboratory, and when Erwin Schrödinger came he, too, took an interest in the low-temperature work. H. G. Kuhn had come to work together with D. A. Jackson in the spectroscopy group, and I.C.I. provided for all of them, at least in the beginning."

Voice from the Past

THE Sicilian sun seems to confer the ability to sleep almost as heavily as the Sleeping Beauty. **Mr. W. A. M. Edwards,** I.C.I. Purchases Controller, last month received this letter and felt it was worth sharing with *Magazine* readers. The date 23rd June 1937 really is 1937, he points out, and not, as readers might think, a typographical error for 1957.

> Gentlemen: In going over our old correspondence we have to remark with much disappointment we should have been deprived of any news from you

> since the 23rd June 1937 and we shall be glad to know the cause of such a long silence.
>
> Have you perhaps renounced to deal PUMICE article? Your kind reply will oblige us, as we attach a great weight to your business connections we would do our utmost to assist you.
>
> Hoping you will revive in any case PUMICE business and always at your service, we are, dear Sir,
>
> Yours faithfully,

Where the Money Goes

LAST year something like £25,000 was handed out in prize money under the I.C.I. Suggestion Scheme. Wilton Works newspaper decided to find out how the money has been spent. Here are some of the answers they got from the men who won the big money at Wilton.

Mr. Norman Eadie, a process chargehand on Polythene Works, who received £500 in August 1958 (a Wilton record), was the first man to be interviewed. For him the award was a real windfall. He had just moved into a new house, and the extra money meant that the family was able to indulge then and there in several luxuries they could not otherwise have afforded for some time to come. Incidentally, Mr. Eadie has since won another award for £5.

Part of the £350 award made to **Mr. Arthur Ellis,** a 36-year-old general worker chargehand in the Wilton Site maintenance section, went towards the 22 ft. five-berth luxury caravan now parked at Brotton, near Saltburn-on-Sea, which is the family's home-from-home on summer weekends. Similarly, the £90 cheque received by **Mr. George Robinson,** an autoclave operator on the Nylon Plant, helped to make possible the acquisition of a Bedford Dormobile van which now comfortably transports the Robinsons and their four children around the countryside most weekends.

* * *

Mrs. Meaburn, wife of **Stanley Meaburn,** a drawframe operator on 'Terylene' Works, is now the proud possessor of a new fur coat, thanks to the Suggestion Scheme. The money remaining of his £220 award Mr. Meaburn has prudently put away against a rainy day. The most recent award at Wilton—£100 to **Mr. C. H. Simpson** (Nylon Works) has also been put in reserve—for when he retires.

D.I.Y. Organ

TWO Metals Division employees, **Mr. and Mrs. John Snell,** are "do-it-yourself" enthusiasts in the grand manner. They build organs. John Snell is head of the radio laboratory at the Steatite and Porcelain Products factory at Stourport, and his wife Ann is a lab assistant there. Organ building is only their hobby, but they have built up a local reputation a professional might envy.

Most of their time is taken up repairing and restoring old organs, although they are currently engaged in

IN BRIEF

Aid for Chile. I.C.I. has given £1000 to the earthquake disaster appeal launched by the Anglo-Chilean Society.

Band's successes. For the fourth year in succession the I.C.I. (Alkali) Band has won its way to the finals in London of the *Daily Herald* National Brass Band Championship. They qualified to compete in London in October by being placed third in the recent area championships in Bolton.

Expansion at Hillhouse. Plastics Division is planning to expand its capacity of polyvinyl chloride (p.v.c.) by a further 10,000 tons by the middle of next year. The expansion will take place at Hillhouse Works in Lancashire, where all I.C.I.'s p.v.c. (at present about 70,000 tons a year) is produced.

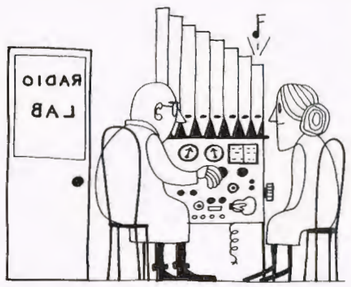
Bribery of the best sort. On 4th May Dr. R. G. Heyes kept his promise to members of the Hillhouse first aid team to give them and their wives a night out if they won the finals of the Company First Aid Competition. After cocktails and dinner in the factory canteen, they were whisked off to the Tower Circus at Blackpool for all the thrills of the Big Top.

They met the Duke. Members of the Billingham Synthonia Junior Club were among representatives of Durham County Youth organisations who were at the recent gathering at Durham Technical College attended by the Duke of Edinburgh. The Billingham representatives were chosen from among the 14 members of the Junior Club at present working for the Duke of Edinburgh's Award.

First film. Polypropylene cast film is now being produced in this country for the first time by British Visqueen Ltd., an I.C.I. subsidiary. It resembles polythene film in appearance, but its advantages include higher melting and softening temperatures, which means it can be used among other things for boil-in-the-bag foodstuffs packs and surgical sterilisation packs.

New look in radios. Three manufacturers, Murphy Radio, J. & A. Margolin, and Pilot Radio and Television have introduced radio sets covered with 'Novon' 504, a new I.C.I. (Hyde) plastic foil. The 'Novon' foil is vacuum formed over cabinets hitherto covered in leathercloth by hand. This new method is both cheaper and faster than the old method.

building from scratch an organ of their own design. Their most ambitious job to date has been the restoration of a fine old organ at Witley Court, near Stourport. The chapel, which stands next to the ruined shell of the great house, is now the parish church of Witley village and has been restored by the Council for the Preservation of Historic Churches. The Snells landed



the job of restoring the organ, installed in 1860 by Lord Dudley. Incidentally, the first organist was a Walter Parratt, who in later life became organist at St. George's Chapel, Windsor, and Master of the Queen's Music.

As We Were

We are back to where we were and humbly eating our hats into the bargain. As readers will have noticed the back cover of the *Magazine* is again occupied by a photograph and not, as recently, by Mr. Thrower's gardening note. Mr. Thrower's article appears instead on page 231 of this issue.

The decision to do away with the back cover picture was taken in the belief that one good colour picture on the front page was enough. However, as so many of you have deplored the end of the black and white back cover picture and as the *Magazine* has been found to look rather unfinished with an article on its last page, the Editor has decided to reinstate this feature.

So once again we are on the look-out for really good black-and-white photographs taken by employees of either home or overseas companies and, incidentally, there is a £5 cheque for any accepted.

50 YEARS' SERVICE

The following employees have completed 50 years' service with the Company: **Alkali Division:** Mr. W. E. Cooper, Winnington Works (1st June); Mr. A. Dooney, Fleetwood Works (18th May); Mr. S. Turner, Winnington Works 1st June); Mr. T. Wright, Fleetwood Works (6th June). **Nobel Division:** Mr. W. Scott, Ardeer Factory (31st May); Mr. B. J. Whale, Ardeer Factory (3rd June).

APPOINTMENTS

Some recent appointments in I.C.I. are: **Alkali Division:** Mr. G. S. Roberts, returning from secondment to Southern Region to occupy post of Personnel Director (in addition to his former duties of Managing Director of Magadi Soda Co.). **Billingham Division:** Dr. A. J. Harding, Project and Process Group Manager; Mr. S. W. Hawkins, Exploratory Group Manager; Dr. A. G. Winn, Works Manager of the Billingham Division plants at Severnside; Dr. P. G. Harvey, Deputy Ammonia Works Manager; Mr. D. K. Peacock, Dowlais Works Manager; Dr. P. W. Reynolds, Manager of the Division Technical Department. **Head Office:** Mr. B. R. Goodfellow, seconded from India Department for special duties in connection with the Common Market; Dr. A. C. Hutchison, head of Technical Department; Mr. G. J. F. Mackay, acting head of India Department; Mr. J. E. A. Stuart, seconded from Alkali Division for a period as Joint Assistant Head of Central Staff Department; Mr. G. H. Payn, Personal Assistant to Mr. R. A. Banks. **Heavy Organic Chemicals Division:** Mr. I. R. Morgan, Chief Accountant. **Nobel Division:** Mr. W. G. McDowall, an Assistant Staff Manager. **Paints Division:** Mr. F. J. K. Hillebrandt, Deputy Chief Accountant. **The Regions:** Mr. R. R. F. MacLennan, Area Manager and Area Chemicals Sales Manager of the Northern Ireland Sales Office; Mr. R. W. Pennock, seconded from Head Office for a period as Deputy Regional Manager, Southern Region; Mr. W. Speira, Area Sales Manager (Chemicals) Newcastle Area Office; **I.C.I. Paints (Malaya) Ltd.:** Mr. H. G. Owen, Director. **I.C.I. (Export) Ltd., Iraq:** Mr. B. Digby, Local Director. **I.C.I. (Export) Ltd., Singapore:** Mr. M. R. Cato, Local Director. **Indian Explosives:** Mr. W. H. Wishart, Works Engineer.

RETIREMENTS

Some recent announcements of senior staff retirements: **Heavy Organic Chemicals Division:** Mr. F. T. Gow, Chief Accountant (retiring 31st December). **I.C.I. Brazil:** Mr. E. M. Lee, Director and Treasurer (retiring 31st August). **Duperial Uruguay:** Mr. K. Knudsholt, Vice-President and General Manager (retiring 31st August).

OBITUARY

Dr. Charles Singer

Dr. Charles Singer died at his home in Cornwall on 10th June, in his eighty-fourth year. In a long life devoted to the history of science and medicine he produced an astonishing number of books and articles that earned him an international reputation as a scholar. His last major contribution was as a joint editor of the five-volume *History of Technology*, sponsored by I.C.I. and published by the Clarendon Press. He began to work on this in 1948 and the last volume was published in 1958. The very favourable reception accorded this authoritative work was due in large measure to his immense learning.

General Chemicals Division's acrylonitrile plant at Cassel Works, Billingham, which started up last December. Among the largest customers in this country for acrylonitrile, which previously had to be imported, are Chemstrand for their "Acrilan" fibre plant in Northern Ireland, Courtaulds for "Courtelle" fibre, and our own Plastics Division for 'Butakon' synthetic rubbers.

The World Honours

THE ROYAL SOCIETY

1660 — 1960

By F. A. Freeth, F.R.S.

The entrance to the Royal Society building in the courtyard of Burlington House, Piccadilly

This month the Royal Society celebrates its 300th birthday. I.C.I.'s senior F.R.S. here discusses the debt this Company—and the world—owe to this exclusive body of learned men whose reputation is second to none.

THIS year the Royal Society of London for Improving Natural Knowledge (to give it its full title) celebrates its three-hundredth anniversary. The Society's patron, Her Majesty the Queen, will inaugurate the official celebrations towards the end of this month, and representatives from some thirty learned societies abroad will be present, as well as distinguished scientists from more than 100 universities. Congratulatory addresses will flow in from all over the world, and among tributes of other kinds is a series of announcements being published by I.C.I. in the national press under the title "Salute to the Royal Society"—public acknowledgment of the inspiration the Society has afforded British industry.

What *is* so special about the Royal Society? Why is it held in such unique regard in scientific circles everywhere? What is the debt that I.C.I., and industry generally, owe it? As a Fellow of 35 years standing, I will try to tell you.*

There are probably few people today who would deny there is something special about the Society, though in the past it has had its detractors among those who didn't understand what it was driving at. Jonathan Swift caricatured it rather cruelly in his *Voyage to Laputa:*

> The first man I saw was of meagre aspect, with sooty hands and face, his hair and beard long, ragged and singed in several places. His clothes, shirt and skin were all the same colour. He had been eight years on a project for extracting sunbeams out of cucumbers, which were to be put into vials hermetically sealed, and let out to warm the air in raw, inclement summers.

By and large, to "shine in the dignity of F.R.S." (as Pope satirically put it) is an ambition nourished even by men who would scorn other forms of recognition. You'll find some amusing references to this in fiction. In *Kim*, Rudyard Kipling describes the aspiration of one Creighton:

> No money and no preferment would have drawn Creighton from his work on the Indian Survey, but deep in his heart also lay the ambition to write "F.R.S." after his name. Honours of a sort, he knew, could be obtained by ingenuity and by the help of friends, but to the best of his belief nothing save work —papers representing a life of it—took a man into the Society which he had bombarded for years with monographs on strange Asiatic cults and unknown customs. Nine men out of ten would flee from a Royal Society *soirée* in extremity of boredom; but Creighton was the tenth, and at times his soul yearned for the crowded rooms in easy London, where silver-haired bald-headed gentlemen who know nothing of the Army move among spectroscopic experiments, the lesser plants of the frozen tundras, electric flight-measuring machines, and apparatus for slicing into fractional millimetres the left eye of a female mosquito.

There is indeed a certain exclusiveness about the Society that does not in itself explain how the Society has managed to enter the modern age with a scientific status and reputation for integrity second to none.

Charles II, who granted the charter of the Royal Society, and took an active interest in its affairs, as depicted in the first of the series of advertisements in which I.C.I. pays tribute to the Society

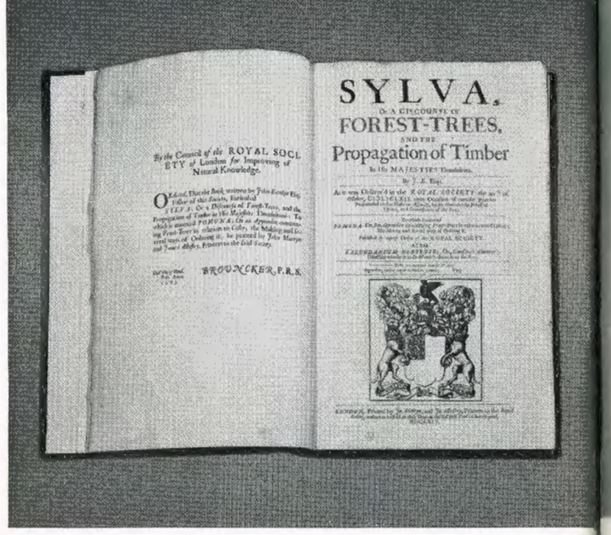
Edmond Halley, *son of a soap boiler, Astronomer Royal, F.R.S.* 1678–1742. *He is famous for his calculation of the orbit and return of the* 1682 *comet, strikingly verified in* 1758.

Only 25 Fellows a year may be elected (foreign members, invariably scientists of great international distinction, are limited to four a year). To be elected, you must be proposed for Fellowship by a certificate in writing signed by at least six Fellows. The certificate comes before one of eight committees representing the various sciences, each committee eight to twelve strong with members retiring in staggered rotation to ensure continuity. The committee recommend three names each and send their choice to the Council, who put forward 25 names for election in a confidential list. The final election is in the hands of the Fellows themselves.

The first name written in the Charter Book signed by all newly elected Fellows is that of Charles II. And that takes me back to the foundation of the Society 300 years ago.

In the middle of the seventeenth

* The list of I.C.I. men who have become Fellows of the Royal Society is as follows: Dr. Ludwig Mond (1891), Sir Frederick Keeble (1913), Dr. E. F. Armstrong (1920), Dr. F. A. Freeth (1925), Lord Melchett (1928), Sir Robert Mond (1938), Sir Wallace Akers (1953), Sir Christopher Hinton (1954), Sir Alexander Fleck (1955), Sir Ewart Smith (1957), Dr. F. L. Rose (1957), Dr. P. W. Brian (1958) and Dr. R. Holroyd (1960).



LEFT
A pioneer electrical machine *made by Joseph Priestley, F.R.S., in the eighteenth century to demonstrate how electricity could be produced by friction. It stands about 3½ ft. high. The handle turns a wheel which rotates the glass bowl over a pad of black paper which in turn strikes sparks off a chain suspended beneath.* BELOW: **An early vacuum pump.** *This instrument was made by Hawksbee and bequeathed to the Royal Society in 1715 (he was a maker of instruments and not an F.R.S.). Made mainly of brass on an elaborately carved mahogany stand, its prime purpose was to discover what happens to small living creatures such as mice, frogs and lizards, or plants when deprived of air. Specimens could be suspended on the hook by a rod from the top of the glass bell jar. The air could then be drawn out of the jar by turning the handle, thus setting in motion the two brass cylinders which force a narrow tube up into the jar and suck the air out.*

ABOVE
The Royal Society's two first books. A Discourse of Forest Tree and the Propagation of Timber *by John Evelyn is the earliest Royal Societ publication—in* 1664. *This is not specially rare—value about* £20. Micro graphia *by Robert Hooke is the second book sanctioned by the Royal Society Much more rare, it is valued at about* £250. *Hooke drew the original illustra tions, and the one reproduced here is of a flea as seen through a simp microscope of that time.*

century there were only two universities in England, and no popular education. But there were a good number of grammar and other schools and classical scholarship was well established. Of science (as we now call it) there was more knowledge than you might think. Astronomy was well to the fore. Physics was going ahead, with chemistry limping along well behind. Mathematics—possibly the most important science of all in the long run—was well established. It was against this background that a group of men, each remarkable in his own way, began to meet in London and discuss what they called Experimental Philosophy. The group at first comprised Robert Boyle, John Wilkins, John Wallis, John Evelyn, Robert Hooke, Christopher Wren and William Petty.

When Charles II returned to London in 1660 and life began to be more settled, the experimental philosophers wanted to put their meetings on a regular footing. They decided on weekly meetings at Gresham College, for which all members should make a down payment of 10s., with another 1s. a week to defray expenses. On 28th November they drew up a list of 40 names "willing and fit to joyne with them in their designe" and elected Lord Brouncker their president. This was the beginning of the Royal Society, though it was still without a name or Royal Charter.

From the galaxy of talent presented by some 6000 Fellows past and present it is an invidious task to pick out a mere handful for the contribution they have made to the chemical industry. Obviously Cavendish, Priestley and James Watt should be mentioned, for their famous discoveries in the eighteenth century all contributed to the building of industry in the nineteenth. I think that John Dalton (elected in 1820) probably deserves the palm. He was the originator, of course, of the Atomic Theory—and there is nothing like a good theory, for it not only explains what has happened to date but also serves as a searchlight for future discoveries.

Since we are mostly concerned with chemistry, it is in the nineteenth century—the golden age for this branch of science—that we find our richest haul. W. H. Perkin (elected in 1866), for example: his discovery of synthetic mauve was the beginning of the whole of the modern dyestuffs industry. J. P. Griess (elected 1868) is another name well known at Blackley, for he discovered the diazo compounds that still form the basis of many dyes.

We must not forget Ludwig Mond—the founder of our Alkali Division—or Walter Weldon (1882), who invented an important process for making chlorine. Chlorine compounds nowadays are used as refrigerants, and that is the cue to bring in Thomas Andrews (1849), who did much of the early work on refrigeration, and James Dewar (1877), who invented the vacuum flask.

While we are still in General Chemicals Division territory, so to speak, I must mention Sir Henry Roscoe (1863), who was a professor of chemistry in Manchester and an associate of H. Y. Castner in aluminium manufacture, eventually becoming a director of the Castner-Kellner Alkali Company. (Curiously enough, Castner himself was never elected a Fellow.) Look at almost any other I.C.I. Division, and you will see behind its processes the shadowy figure of an F.R.S. or two. Billingham Division, for example: von Liebig (1840), Lawes (1954) and Sir William Crookes (1863) were all pioneers of fertilizer chemistry. Nobel Division: the manufacture of silicones can be traced back to F. S. Kipping's research into silicon chemistry 50 years ago. Fibres Division: the whole business of man-made fibres began with John Mercer (1852) and Sir Joseph Wilson Swan (1894), who laid the foundation for rayon manufacture.

I could go on like this for a long time, without even touching on other Fellows—such as Lockyer, Joule, Lord Kelvin, Swinburne, Parsons, Thompson, Rutherford—whose contribution to the chemical industry has been less specific. Perhaps if I single out one more it should be Lord Rayleigh (1878), to whom we owe the discovery of argon, widely used in welding and in the melting of titanium. But from the examples I have given, it is easy to see the size of the debt to the Royal Society. And in more recent years the connection between it and industry has been even more direct, for while distinguished industrial scientists have been elected Fellows, many Fellows have become consultants to companies like I.C.I.

This is not to say that great work has not been done by people outside the Society, or that all Fellows have always been brilliant scientists; in fact, there have been times in the history of the Society (fortunately now long past) when only about a third of the Fellows could be regarded as scientists at all. But at all times it has served as a rallying point for scientific thought in this country. It has stimulated the association of scientists of one discipline with scientists of another (more important than ever in these days of specialisation), and scientists of this country with scientists abroad, so providing a fruitful cross-fertilization of ideas.

Goat Market, Haarlem

Photo by Miss J. E. Green (Paints Division)